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EFFECTIVENESS OF AWARD FEE PROVISIONS IN DARCOM CONTRACTS.(U)
JAN 77 S H CARTER

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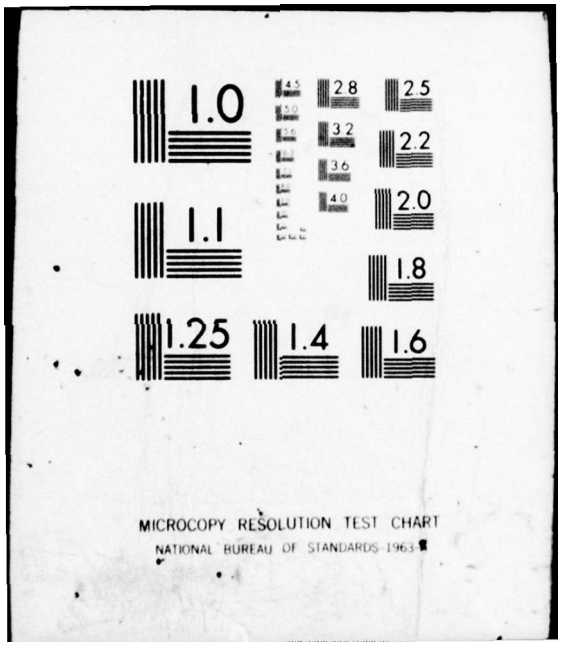
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EFFECTIVENESS OF AWARD FEE PROVISIONS IN DARCOM CONTRACTS

JANUARY 1977

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(14) APRO-513-F

FINAL

(6)

EFFECTIVENESS OF AWARD FEE PROVISIONS IN DARCOM CONTRACTS.

(9) Final rept.

(11) Jan 1977

by

(10) Shirley H. Carter

(12) 70p.

Information and data contained in this document are based on input available at the time of preparation. Because the results may be subject to change, this document should not be construed to represent the official position of the US Army Materiel Development and Readiness Command.

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EXECUTIVE SUMMARY

PROBLEM

The Cost Plus Award Fee contract (CPAF) is an appealing concept because it allows procurement managers to use judgement in rewarding performance. It has recently been alleged, however, that a high and relatively constant percentage of the award fee is always paid. If this is true, the effectiveness of CPAF contracts relative to other types is in doubt.

OBJECTIVES OF THE STUDY

1. Establish current level of award fee payments within Army contracts.
2. Investigate procedures to determine what award fee to pay.
3. Accumulate evidence indicating the motivational effectiveness of cost-plus-award-fee contracts.
4. Evaluate current guidance for the use of CPAF contracts.
5. Recommend change in use or guidance, if appropriate.

SCOPE AND METHODOLOGY

The data base for this study consisted of (1) 19 completed DARCOM CPAF contracts in the 1970-1975 timeframe (approximately 1/2 of the population), (2) 26 active CPAF contracts (about one-third of the discernable population), and (3) responses from experienced CPAF users in each Major Subordinate Command (MSC) in DARCOM.

Inferences toward the above objectives were drawn from analyses of award fee payment level, the relationship of award fee payment to various other variables (e.g., fixed fee base), time and command trends, and qualitative assessments.

CONCLUSIONS AND RECOMMENDATIONS

The current mean level of award fee payments is 83% with a standard deviation of 6%. This average and spread are consistent with the NASA and DOD award fee rating system. Extensive investigation reveals that individual awards vary extensively over a wide range and that it is not true that a high and relatively constant percentage of the award fee is always paid. Award fee payments have not been automatic; they vary significantly in relative size with performance indicating that the CPAF contract type is effective. Award fee payments have not varied significantly among commands nor with time. None of the other external factors examined appear to influence the award fee amount. However, some problems remain, including one defect in the evaluation procedure that results in a bias in award fee payments under certain circumstances. The procedures used for determining the amount of award fee to pay are comprehensive and appear to be working in the field as evidenced by award fee results as well as direct inspection and evaluation of the procedures. The technique is necessarily very flexible and utilizes different philosophies in different applications. This creates the need for an interchange of ideas and experience among technical personnel of the various commands. It is recommended that research continue and that DARCOM strengthen its policy on award fee contracting to facilitate the interchange of experience and research.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

A. BACKGROUND

The Cost Plus Award Fee (CPAF) contract is a cost reimbursement contract which has been used by the DOD and NASA since 1962. It was developed to provide a means of establishing contractual incentives where the development of firm objectives for cost, technical and management performance could not be made. Recently two major expressions of concern within the Army have arisen concerning the use of CPAF contracts. One involves the adequacy of guidance documents for structuring the contract and in evaluating contractor performance. The other related concern involves the appropriateness and motivational effectiveness of CPAF contracts in accomplishing their intended purpose; i.e., contractor motivation. To address these issues this study evaluates a unique feature of CPAF contracting; i.e., award fee payments, and evaluates the effectiveness of the fee awarded as a motivational factor in contract performance.

B. PROBLEM

The award fee is an appealing concept since it is a means for applying incentives in those cost reimbursement contracts that do not readily lend themselves to finite measurements of performance required for structuring

incentive contracts. However, a shadow of doubt has been cast over the effectiveness of the award fee as a motivational device. It has been alleged that a high and relatively constant percentage of the award fee is always paid. If this is uniformly true then it would appear, on the surface at least, that the cost-plus-award-fee (CPAF) contract differs little in operation from a cost-plus-fixed-fee (CPFF) contract. In fact, if practice reveals a lack of award fee motivation, then the higher administrative cost of the award fee feature would make the CPAF contract less desirable than the CPFF contract.

In view of the above, an assessment and evaluation of award fee payments under Army contracts is in order.

C. OBJECTIVES

The objectives of this study are to: (i) establish the current level of award fee payments within Army contracts, (ii) investigate the various procedures employed to determine what proportion of the available award fee to award, (iii) accumulate evidence both positive and negative indicating the motivational effectiveness (or the lack of motivational effectiveness) of Army cost-plus-award-fee contracts, (iv) evaluate current guidance regarding the use of CPAF contracts, and (v) recommend changes in CPAF usage or guidance, if appropriate.

D. METHODOLOGY

The research methods employed during the study were directed toward obtaining a quantitative assessment of award fee contracts as used in the Army. The procedure involves establishing a theory reflecting what award

fee payments would be expected to be under the hypothesis that they are effective and under the alternate hypothesis that they are ineffective. Then the actual level of award fee payments is computed and compared to the theoretical models. This raises questions that must be answered before a rational assessment can be made. Answers to these questions are pursued in two ways. The current guidance and current usage in determining what awards should be made is investigated and statistical analysis of the data base is employed to assess the effectiveness with which the system operates. A comparison of how individual awards are distributed versus how they would be expected to be distributed under both hypotheses is investigated to establish the structure necessary to give the previous assessments additional meaning. Conclusions are then developed as the facts warrant.

E. SOURCES OF INFORMATION

Information used in the analysis was derived from two sources. The first source consisted of a data base of completed CPAF contracts and a second more limited data base from ongoing contracts. Both of these data bases are described at the beginning of Chapter III.

The second type of information used in the study is qualitative in nature and was obtained from a review of contract files and from interviews with those personnel experienced in the use of CPAF contracts. Personal interviews were conducted with procurement policy staffs, contracting officers,

contract specialists and members of award fee boards. The extensive experience and knowledge of these experts were most helpful in interpreting the data obtained from individual contract files and in providing examples of the effect of award fee on the motivation of contractors.

F. ORGANIZATION OF REPORT

Chapter II contains a brief discussion of the application, limitations and guidance documents pertaining to CPAF contracting and also contains an evaluation of the guidance. Some problems are also surfaced here. In Chapter III a brief description of the data base (a more complete description is contained in Appendix A) is presented followed by an analysis of the level of award fee payments. Chapter III also provides observations and statistical analysis directed toward resolving some of the problems encountered to provide sufficient information to evaluate the effectiveness of the procedure and its application in field use. Chapter IV presents the conclusions and recommendations of the study.

CHAPTER II

AWARD FEE CONTRACT GUIDANCE, THEORY AND FIELD APPLICATION

A. GENERAL

This chapter briefly reviews the current policy and theory of award fee contracting. The theory is then analyzed as the basis to investigate field application. Then field experience is evaluated in light of these findings with the view of separating the problems of an unresolved nature from those that have been successfully solved. The results are then related back to the theory and guidance.

B. REVIEW OF CURRENT GUIDANCE

This section contains a brief outline of the application and limitation of CPAF contracts and a summary review of the appropriate guidance documentation in the area.

1. Application and Limitation of CPAF Contracts

The CPAF contract provides a means of applying incentives in cost-reimbursement contracts which are not susceptible to development of scaled objectives for cost, technical, and management performance. A CPAF contract includes: (1) an estimated cost, (2) a base fee which does not vary with performance (the base fee may be zero), (3) an award fee which may be earned in whole or in part or not at all with the amount actually awarded to be determined by a subjective evaluation of performance measured against the performance criteria set forth in

the contract, (4) a maximum fee (base fee plus award fee pool), (5) performance criteria, and (6) the fee payment plan. CPAF contracts are appropriately used for:

> (i) level of effort contracts for performance of services where mission feasibility is established but measurement of achievement must be by subjective evaluation rather than objective measurement and
> (ii) work which would have been placed under another type of contract if the performance objectives could be expressed in advance by definite milestones, targets or goals susceptible of measuring actual performance.[1]

CPAF contracts are not used:

> (i) . . . as an administrative technique to avoid CPFF contracts when the criteria for CPFF contracts apply, nor shall a CPAF contract be used to avoid the effort of establishing objective targets so as to make feasible the use of a CPIF type contract.
>
> (ii). . . where the contract amount, period of performance or the benefits expected are insufficient to warrant the additional administrative effort or cost.
>
> (iii). . . for procurements categorized as either Engineering Development or Operational System Development (see 4-101(a)(6) a (7)) which have undergone contract definition, except that where it may be more advantageous to do so, it may be used in these categories for individual procurements, ancillary to the development of a major weapon system or equipment, where the purpose of the procurement is clearly to determine or solve specific problems associated with the major weapon system or equipment.[2]

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[1] ASPR 3-405.5(b) dated 1 Oct 75.

[2] ASPR 3-405.5(g) dated 1 Oct 75.

More detailed definitions as well as applications and limitations on the use of CPAF contracts are contained in various procurement guidance documents of the DOD and NASA. For in-depth information on CPAF contracting the reader is referred to these documents which are now briefly summarized.

2. Guidance Documents

a. Armed Services Procurement Regulation. The primary and most succinct source of guidance on the use of CPAF contracts is contained in ASPR 3-405.5. Excerpts from this guidance are cited above for general information on CPAF contracting. More detailed information, e.g., amount of base and maximum fee and evaluation considerations and criteria, are included in the ASPR and are necessary reading for those personnel preparing for the solicitation and award of CPAF contracts.

b. DOD and NASA Incentive Contracting Guide. The DOD and NASA Incentive Contracting Guide dated October 1969 contains one chapter on CPAF contracts. However this guide only covers the subject in general terms and from a philosophical viewpoint. It provides little information not contained in the above cited ASPR reference.

c. NASA Cost Plus Award Fee Contracting Guide. The NASA Cost Plus Award Fee Contracting Guide dated August 1967 is the most comprehensive Government document on CPAF contracting. Structuring contracts and establishing evaluation criteria as well as organizing for

the administration of contracts are very effectively covered. Also examples of award fees and a study of CPAF contractual "theory" are presented. Unfortunately the "theory" is on a philosophical plane and provides little help toward application other than to very adequately summarize the concepts involved. It provides a compendium of the often conflicting economic, psychological and sociological explanations of individual motivation. It does provide an extensive enumeration of the many factors and effects that may operate and therefore should be considered in this very nebulous area.

d. Army and DARCOM Regulations. Supplemental regulations on the use of CPAF contracts are not contained in the Army Procurement Procedures. However, DARCOM Circular No. 715-9-75 dated 10 September 1975 provides command procurement instructions on the designation of award fee determining officials for CPAF contracts.

e. Major Subordinate Command Regulations. Except for coverage in the ASPR, there is a general dearth of enlightening information on CPAF contracting at the DOD, Army and DARCOM levels. As a result, most MSC's of DARCOM have issued their own comprehensive regulations and instructions. Although most of these regulations and instructions describe circumstances which are unique to a particular installation, and therefore reflect to some extent individual command philosophy much of the information is duplicatory and similar to the more general information and procedures contained in the NASA Cost Plus Award Fee Contracting Guide.

C. ANALYSIS OF CPAF CONTRACTING "THEORY"

The purpose of the award fee provision is to motivate a contractor to stimulate outstanding performance in areas that cannot be objectively measured. The primary vehicle is profit translated into terms of an award fee payment that is in turn related to a subjective evaluation of (nonquantifiable) performance in selected areas:

> Profit generally, is the basic motive of business enterprise. Both the Government and its defense contractors should be concerned with harnessing this motive to work for the effective and economical contract performance required in the interest of national defense. To this end, the parties should seek to negotiate and use the contract type best calculated to stimulate outstanding performance. The objective should be to insure that outstanding effective and economical performance is met by high profits, mediocre performance by mediocre profits, and poor performance by low profits or losses. The proper application of these objectives on a contract by contract basis should normally result in a range of profit rates.[3]

> . . . In certain cases, it may be desirable to motivate and reward a contractor for management performance over and above that which can be objectively measured and incentivized under other forms of government contracts. For example, logistics support, quality, timeliness, cooperation, ingenuity, and cost effectiveness are areas under the control of management which may be susceptible only to subjective measurement and evaluation. In such cases, the "award amount" portion of the fee applicable to the CPAF contract is an ideal method for incorporation of these additional incentives into government contracts. . . [4]

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[3] ASPR 3-401(b)(1) dated 1 October 1975.

[4] ASPR 3.405.5(h) dated 1 October 1975.

It is concluded therefore that performance is to be equated to profit on the award fee payment in the following way:

Performance		Profit
OUTSTANDING	=	HIGH
MEDIOCRE	=	MEDIOCRE
POOR	=	LOW OR NEGATIVE

The negative profit alternative is not a part of the award fee feature unless the complicating economic concept of opportunity cost or potential profit foregone, is taken into account. This approach was avoided for the purposes of this study.

The key question is obviously exactly how is this relation to be established. An example of a criteria for evaluating contractor performances is given in ASPR 3.405.5(y)(i) where performance is ranked from Excellent down to Submarginal and then equated to a numerical measurement scale of 100 to 0. Since the relevant variables making up the quality of performance, by definition, cannot be measured exactly in the award fee case the scores provided in the example have to refer to contractors in general when thinking in terms of absolutes. In terms of award fee evaluation it provides a conceptual framework for a point of reference but it can only be applied literally in a relative (subjective) sense and not as a literal linear transformation (absolute sense). It is in fact a flexible guide.

> . . . The number of criteria used and the requirements which are represented will differ widely from one contract to another. Therefore, when determining criteria and rating plans the using activity should be flexible and select a plan which will motivate the contractor in a positive way to improve performance. . . [5]

The suggested evaluation then is a flexible, relative aid to equate performance (as subjectively evaluated against internal goals unique to that contract) to an award fee payment (a direct representation of profit.) NASA has suggested a different plan for making this conversion using some of the same words but associated with different levels on a numerical "point" scale. The relationship of these two systems is shown in Table 1.

The NASA plan is based on the perception of a set of utilities differing somewhat from those implied in the DOD suggested evaluation. NASA defines an overall contractor performance evaluation score of 80 as corresponding to what is normally expected of a contractor and also defines this point on the scale as the median numerical rating. An award fee of 50% is then equated to the median contractor score of 80 points. The full scale of potential award fees is developed as shown in Table 1 based on their stated assumption of linear deviations from the median.

It follows from the above that an "average" contractor doing what is normally expected would earn an award fee of 50% under this system.

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[5] ASPR 3-405.5(a)

Successful efforts to motivate a contractor toward improved performance results in an award fee payment above 50% with the desired goal of superior performance resulting in award fee payments within the 90%-100% range.

The DOD plan does not define a specific point on the contractor performance evaluation scale reflecting what is "normally expected" of a contractor. However, if the criteria used by NASA (The mid-point of their "good" rating) is applied to the DOD scale, as is often done in the field, a rating of 75 points emerges as the normal standard. These differing views of what is the expected standard reference point to use in evaluating a specific contract contribute to various interpretations in the field and widely differing award fee scales. (see Table 2)

D. EVALUATION OF FIELD EXPERIENCE IN RATING

1. The Effective Scale Used in Evaluation

Often in the award determining procedure, factors are quantified on a rating scale of zero to 100. Then some minimum level of performance is required (usually 60 to 70 points total score) to achieve any award. The apparently obvious fact that the scale of 0 to 100 is being used to determine the amount of the award is misleading. That part of the scale below the cut off point, say 70 points, is used only to determine if any award fee is to be paid. The scale above the cut off point, in this case the 30 points between 70 and 100, becomes the effective range of the scale for determining the amount of the award.

TABLE 1

DOD CONTRACTOR PERFORMANCE EVALUATION AND

NASA CPAF SUPPORT CONTRACT RATING SYSTEM

DOD Contractor Performance Evaluation		NASA Rating System for CPAF Support Contracts		
Evaluation	Score	Adjective Rating	Points = % Award	Specific Adjective
	100		100	Superior
	99	Superior	97.5	
	.		92.5	Superior Minus
Excellent	96		90	
	95			
	.		87.5	
	91	Excellent	85	Excellent Plus
			.	
	90		75	Excellent
	.		.	
Very Good	86		67.5	Excellent
	85		65	
	.			
	81	Good (Median) NASA Expected Performance	62.5	
			60	Good Plus
	80		50	Good
	.		.	
Good	76		42.5	Good Minus
	75		40	
	.			
	70		37.5	
		Satisfactory	35	Satisfactory Plus
	69			
	.			Satisfactory
	66		17.5	Satisfactory
Marginal	65		15	Minus
	.			
	61		12.5	
			10	Fair Plus
		Fair	2.5	
	60		0	Fair
	.			
Submarginal	0			

2. Widely Differing Conversion Methods

Each award fee contract is an individually tailored document designed to meet a specific and unique situation. It is necessary that the procedure retain its flexibility to permit exact "tailoring" to meet the differing situations of each contract. However, it is questionable if some of the diversity encountered in the field is actually necessary or desirable. The motivation behind some of the more unusual conversion schemes often seems to be an attempt to engineer the award fee toward some predetermined level rather than to enhance performance on the critical areas of the contract. The procedure almost universally employed to determine the appropriate award fee is to build up a composite score from many factors and subfactors and then to convert this score into a percentage of the award fee. In some cases the score and the percentage of the award are the same, in others they differ widely. A score of 99 (out of a possible 100 points) for example would result in award of the potential (maximum) award in some cases, in others it would result in percentages as shown in Table 2. There may sometimes be valid reasons for such a procedure but it gives the appearance of reducing the award below what was apparently earned. A more direct approach would be a straightforward conversion with the evaluation contained within the score system, not added later by conversion.

3. Detailed Micro Evaluations

The concept of an award fee contract is that it is used in special instances when it is impossible to objectively quantify the performance elements; hence, a subjective evaluation is necessary. Yet, in practice,

TABLE 2

SCHEMES FOR CONVERTING PERFORMANCE SCORE TO AWARD FEE

Contractors Performance Evaluation		Conversion schemes for transforming the contractor's evaluation score to the percentage of award fee to be paid		
Evaluation	Score	#1	#2	#3
		PERCENT AWARD FEE TO AWARD		
Excellent	100	100	100	100
	99	97.5	96.7	96
	:	:	:	:
	91	77.5	69.9	64
Very Good	90	75	66.6	60
	:	:	:	:
	81	52.5	36.6	24
Good	80	50	33.3	20
	:	:	:	:
	76			4
	75			0
	:	:		
	71	27.5	3.33	
Marginal	70	25	0	
	:			
	61	2.5		
Sub-marginal	60	0		
	:			
	0			

the evaluation on most award fee contracts is broken down into many factors and subfactors and sometimes contain a further breakdown into individual elements - all of which are scored numerically. There are some circumstances when this is reasonable such as when this type of contract is used as a transition from a previous fixed fee to a future incentive contract. In such a case one of the purposes of the award fee feature is to develop such a quantitative evaluation system. There are perhaps other special conditions that warrant such an evaluation but the prevalence of the practice raises the question; If the evaluation process is really subject to such detailed and accurate measurement why isn't it already an incentive contract (CPIF)? The fragmentation of objectives by such a detailed breakdown may very well dilute the incentive feature. Contracts have been scored on such a low level of detail that in one case a single factor was worth $28. On the other hand, notable success has been obtained in some contracts that concentrate the award on a few, four or five, really important factors.

4. The Averaging Effect in Detailed Evaluations

Another effect involved in contracts with detailed breakdown of the award fee results from the mechanics of determining the fee. Consider a detailed evaluation procedure. An individual element is evaluated over several months, usually three or six, by each of several COR's. First each COR averages his monthly scores, which may be different, then the individual COR's evaluations are averaged. The elements are then weighted and combined

into factors that make up a total score. This averaging effect tends to bring the scores toward the center of the portion of the scale that is effectively used. The chances of a contractor obtaining a perfect score are slim indeed. The only way this can be accomplished is for each individual micro-evaluation to be uniformly high, an unlikely event under most circumstances. Suppose the contractor did a perfect job and one COR for some reason erroneously rated him low. The magnitude of the error will be mitigated to some extent by averaging with many other factors all of which we hope are correct. However, the error will never be "averaged out" and he will not receive a perfect score to match his perfect performance, unless of course someone gives him a "better than perfect" score, and this doesn't happen in practice.

This can be easily demonstrated with a simple example. Table III shows an example of a hypothetical performance evaluation containing an erroneous rating on a "perfect" contractor. The contractor fully met all criteria on each rating item and should have received 100 ratings for each sub-category resulting in a total weighted rating of 100. However, the contractor was erroneously given an 80 rating under criteria A-1 (shown in parenthesis). The effect of this downgrade is carried through the roll up, as shown by the figures in parenthesis, with no chance of being corrected by compensating errors. The final result is a total score of 97.6 points. This results in the award fee being reduced from its correct value of 100% by a factor determined from the particular conversion scheme used. The key point is that there is no possibility of other errors compensating for the original rating error and "averaging" it out of the rating system.

TABLE 3

EXAMPLE OF A HYPOTHETICAL BIASED CONTRACTOR PERFORMANCE EVALUATION REPORT RESULTING FROM AN INCORRECT RATING

CATEGORY CRITERIA	RATING	ITEM FACTOR	EVALUATION RATING	CATEGORY FACTOR	EFFICIENCY RATING
A. TIME OF DELIVERY					
A-1	100 (80)	X .40 =	40 (32)		
A-2	100	X .30 =	30		
A-3	100	X .30 =	30		
	TOTAL ITEM WEIGHTED RATING		100 (92)	X .30 =	30 (27.6)
B. QUALITY OF WORK					
B-1	100	X .15 =	15		
B-2	100	X .30 =	30		
B-3	100	X .20 =	20		
B-4	100	X .15 =	15		
B-5	100	X .20 =	20		
	TOTAL ITEM WEIGHTED RATING		100	X .40 =	40
C. EFFECTIVENESS IN CONTROLLING AND/OR REDUCING COSTS					
C-1	100	X .30	30		
C-2	100	X .40	40		
C-3	100	X .40	40		
	TOTAL ITEM WEIGHTED RATING		100	X .30 =	30
				TOTAL WEIGHTED RATING	100 (97.6)

The same phenomenon will occur at the other end of the scale (lower end) also, and for the same reason. As the true performance gets closer to either end of the scale, the possibilities of an error compensating for other errors decreases, until with either a totally perfect or totally imperfect performance, all errors will have to be in the direction of the center of the scale and can only have the effect of biasing the evaluation in that direction. On the other hand, when the contractor's performance is more or less "average" then errors by evaluators may be just as likely to be above as below and vice versa, so they will at least tend to average out. But the only way that a perfect score (100) or complete failure (0) can be obtained is for each factor to be evaluated without error by every evaluator, and we really rule this out at the start by definition. If it is possible to identify the appropriate evaluation factors and measure them without error then a CPIF contract would be appropriate not a CPAF.

There is then a bias built into the evaluation procedure that "pulls" both very high and very low awards towards the middle.

5. Other Problems

Several other problems have been surfaced in the past and have largely now been resolved at least on some kind of working basis in the field. The level of the award fee evaluation board and the fee determining official has now been established on a reasonable basis. The question of giving the evaluation plan to the contractor often causes much discussion

within procurement circles. Successful award fee contracts have been administered when the evaluation plan has been given to the contractor and also when it was not given to him. Communicating results of the evaluation to the contractor is another area that often causes difficulty. The contractor needs to know his areas of less than superior performance as well as the areas where he excells if he is to improve in the future. It is important to keep the ultimate objective in mind; maintain a superior performance and thereby earn the maximum award. Establishing the priority of requirements and developing the plan itself are continuing difficulties that require continuing attention. However, these are problems that were troublesome at the beginning of award fee contracting and are now manageable with the development of field procedures and the accumulation of experience.

E. SUMMARY OF CPAF EVALUATION THEORY AND PRACTICE

The award fee provision is intended to motivate a contractor to achieve outstanding performance in areas that cannot be objectively measured. Each contract is individually tailored to meet a specific and unique set of circumstances. Performance which is subjectively evaluated against unique internal goals within a contract must be converted to a numerical award fee payment representing profit to the contractor. The exact methods of the conversion from the subjective evaluation to the numerical reward is detailed in the rating scheme contained within the evaluation plan. The realistic development and implementation of this rating system is one of the more troublesome problems in putting the award fee theory into practice.

In actual practice subjective evaluations are universally converted to numeric ratings by the evaluation and rolled up into an overall numeric rating. This, in turn is mechanically converted into a recommended award fee subject to later review and adjustment. The application of this process creates some problems in the field.

In devising a rating plan for an individual contract, contracting officers need a benchmark on an absolute scale indicating what is normally expected of a contractor to provide a point of reference. The apparent difference between the DOD and NASA suggested standard causes confusion and leads to an unnecessary wide range in conversion methods.

The process of evaluation as now used in the field has an inherent bias built into it at both the high and low extremes of the performance scale that tends to pull extreme awards toward the middle. The process of very detailed micro evaluations often tend to dilute the award fee to a point where its effectiveness in motivating contractor performance is questioned.

CHAPTER III

ANALYSIS OF AWARD FEE PAYMENT DATA

A. GENERAL

In this chapter statistical analysis of data from two sources is presented. First the data bases are described; then the level of current award fee payments is investigated. Next several areas are investigated to assist in determining the effectiveness of the fee determining system. This is necessary to provide a framework in which to interpret the award fee level.

B. DATA BASE

During the course of the study effort two data bases on CPAF contracting were obtained. The first consisted of a sample of relevant information extracted from the files of 19 completed CPAF contracts. This is the base for most of the analysis which follows. The second sample of the existing data for 26 on-going contracts is used to corroborate some of the findings from the analysis of completed contract data. In both cases only "pure" CPAF contracts were sampled. Those with unusual or complicating provisions such as "catch up" or "balloon" provisions and those using the award fee feature in conjunction with other incentive provisions were excluded. The samples were selected in this manner in order to isolate the effects of the award fee behavior as much as possible. Most of these contracts were for engineering and technical services and all were initiated since October 1969. Although both samples are small the completed contract data represented over one half

of all completed CPAF contracts and the on-going data represents over one-third of all on-going CPAF contracts for the time period as reported on the DD Form 350's. A more complete description of the sample data from the completed contracts is contained in Appendix A.

C. LEVEL OF AWARD FEE PAYMENTS

One of the primary objectives of this study was to establish the current level of award fee payments within the Army. This estimate will be based on analysis of the primary data base of completed contracts. But, before proceding directly to the objective it is necessary to investigate the possible effect of two potentially confounding factors; the influence of time and the command where the contract was awarded.

1. Effect of Command on the Level of Award Fee Payments

The procedures employed to detect differences between commands is to compare the mean (average) values within each command. If data on all contracts for each command were available this could be readily done and it could be ascertained at once that there is or is not a difference. But since such data is not available within the practical constraints of this study, the true value for all contracts within a command must be estimated from the data. And since different samples of the same size would contain different combinations of all possible contracts, the resulting estimates of the true values would differ slightly. It is

necessary therefore to apply some decision rule to insure that the differences observed in the sample are not likely due to sampling error (chance) alone but represent some other real differences. This procedure is formally embodied in the standard statistical method of Analysis of Variance (ANOVA) which is used here to test the level of award fee payments for differences between commands, and later for differences due to time. Because of the small sample size, both of these tests are limited in the statistical inferences that may be drawn from them. They are used only to determine if the data may be pooled in computing the award fee payment level. Because of the variability of the data shown in the frequency distribution, Figure 1, the variances were tested in both cases and found to be homogeneous. The results of the ANOVA test for command differences in award fee level is now presented.

TABLE 4

ANALYSIS OF VARIANCE FOR CONTRACT AWARD FEES BETWEEN COMMANDS

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F Ratio	Test* Value
Between Commands	109.34	2	54.67	1.56	3.63
Within Commands	560.86	16	35.05		
Total	670.20	18			

*$F_{(.05, 2, 16)}$

On the basis of this test it is concluded that for the purpose of pooling the data there are no detectable differences between commands in the level of award fee payments for completed contracts. One command has only three contracts and another only five; therefore, no other conclusions are made at this time.

2. Effects of Time on Award Fee Payments

In order to test the effects of time on the level of award fee payments the data are grouped by year of completion. The data for 1972 and prior years is placed in one group because of the small sample and scarcity of data. The results follows.

TABLE 5

ANALYSIS OF VARIANCE FOR CONTRACT AWARD FEES BETWEEN YEARS

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F Ratio	Test* Value
Between years	59.78	3	19.93	0.47	3.34
Within years	590.40	14	42.17		
Total	650.18	17			

*$F_{(.05, 3, 14)}$

On the basis of this test it is concluded that for the purpose of pooling data there are no detectable differences between years in the level of award fee payments for completed contracts.

3. Estimate of the Average Award Fee Payment

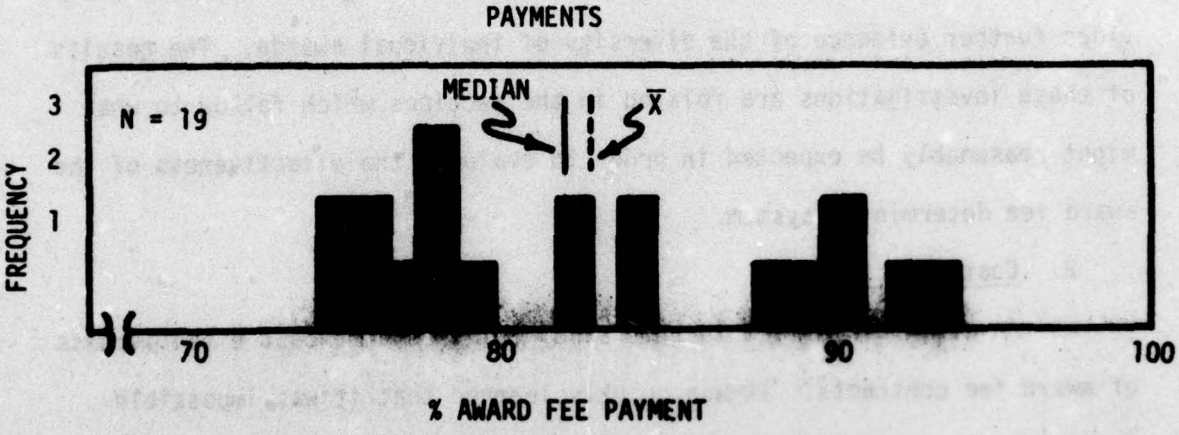
In light of the fact that no evidence was shown of any effect of time of contract completion, or command of contract execution, on the level of award fees paid, it is concluded that we have a homogeneous data base for the purpose of establishing the level of award fee payments within the Army. The best point estimate of the current level of award fee payments as a percentage of the maximum available award fee is given by the sample mean. This value is 83% (Table 6). Because this value is computed from a sample that does not include all award fee contracts that have been completed during the time span of the data base, two range estimates are also given with different confidence levels, based on the sample standard deviation of 5.93%. The ranges are 80.25% to 85.70%, for a 95% confidence level and 78.90% to 87.06% for a 99% confidence level. The statement is made that the true value of award fee payments for all contracts falls within the range specified with the associated degree of confidence (95% or 99%).

TABLE 6 CURRENT LEVEL OF AWARD
FEE PAYMENTS ESTIMATED FROM SAMPLE DATA

Confidence Level	Value Range
N/A (Point Estimate)	82.98%
95%	80.26%-85.70%
99%	78.90%-87.06

FIGURE 1

FREQUENCY DISTRIBUTION OF THE LEVEL OF AWARD FEE CONTRACTS



This brings up the question of what the level of award fee payments should be. If the system is working it should be high, for it is the payment associated with the desired level of performance. However, high payments do not necessarily mean that performance is high unless the evaluation system is working properly. This is the subject of the next section.

D. EFFECTIVENESS OF THE AWARD FEE DETERMINING SYSTEM

1. General

The most desirable way of evaluating the award fee determining system is in terms of over all cost effectiveness. However, the practical problems discussed briefly in section 2 below render such an approach infeasible for this research. The procedure followed is to investigate the

predictability of the award fee payments and their variability. Predictability is associated with the relationship of award fee payments to other selected factors and with their variability. The variability of individual award fee payments is investigated both between different contracts and within individual contracts. Analysis of the on-going contract data provides further evidence of the diversity of individual awards. The results of these investigations are related in the sections which follow to what might reasonably be expected in order to evaluate the effectiveness of the award fee determining system.

2. Cost Effectiveness

An attempt was made in this study to assess the cost effectiveness of award fee contracts. It was quickly learned that it was impossible to isolate the administrative costs with a reasonable amount of resources. This already had been attempted by some contracting officers who found that the day-to-day administrative activities were so intertwined that they defy delineation within any reasonable level of effort. The differences between contracts is tremendous. Estimates for preparation of evaluation board folders varies from three days to three weeks. Board members said that they could not accurately estimate the preparation that they made for the evaluation boards. In view of these difficulties the attempt to compute administrative costs was discontinued. One of the determinations that must be made before the CPAF type contract is selected is that they are expected to be cost effective.

> The CPAF contract shall not be used where the contract amount, period of performance or the benefits expected are insufficient to warrant the additional administrative effort or cost.[1]

In reviewing the contract files and talking with contracting officers and contract specialists the conclusion was reached that CPAF contracts can be cost effective. The technique has been used to successfully obtain goals that were not reached under other contracting techniques. The technique is not universally applicable. However, for selected procurements experience has shown that the benefits obtained fully justify the extra costs involved. The remainder of this chapter addresses the effectiveness side of the cost-effectiveness question.

3. Relationship of Award Fee Payments to Selected Other Factors

Award fee payments have been challenged on the basis that they do not motivate the contractor and are therefore ineffective; it is said that payment depends on: size of contract (dollar value), or absolute size of the potential award fee in dollars (magnitude) or relative size of the potential award (percentage of estimated contract cost), among others. The award fee payments should depend primarily on contractor performance and be related to other factors only to the extent that contractor performance is itself related to them.

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[1] ASPR 3-405.5(g)(ii) dated 1 Oct 75.

It is also possible that the level of award fee payments may be related to the fee structure itself. If this is true then some insight into how to improve the motivational effectiveness of CPAF contracts may be gained from investigation of this phenomenon. These questions are addressed in this section of the report. The method employed for this analysis is the standard statistical technique of simple linear regression analysis with the model:

$$Y = a + bX$$

where

Y - the level of award fee payment

X - the independent variable described in each regression.

The procedure used to test the significance of the regression is an F statistic computed as follows:

$$F_{(r,\ N-2,\ N-2)} = \frac{1 + |\gamma|}{1 - |\gamma|}$$

which is compared with a predetermined test value, here F with alpha = .05 (5% significance level) and 17 degrees of freedom; i.e., $F_{\alpha} = (.05, 17, 17) = 2.27$ if the calculated F value exceeds the test value the association of the two variables is considered significant; not likely to have occurred by chance. Otherwise, the null hypothesis of no correlation cannot be rejected and the association is termed non-significant; likely to have occurred by chance.

In assessing the effect of various factors on the award fee payment in the subsections that follow the methods briefly outlined above are applied at two points in the life of the contract. (As stated previously the independent variable, the award fee payment, can only be determined at the completion of the contract). The relationship of the dependent variables that are alleged to have caused some of the variation in the award fee payments are investigated at contract initiation to develop relationships as the fee structure was planned, and at contract completion to assess how it actually happened. It has already been shown that there is a shift in fee structure between these two points. Therefore the consistency of these two related estimates is also of interest.

a. Effect of Size of Contract on Award Fee Payment. To test the proposition that the size of a contract exerts a positive influence on the percentage of available award fee paid, the estimated cost of initial contracts and completed contracts are compared with the corresponding award fees, yielding the following results:

TABLE 7

REGRESSION OF AWARD FEE PAYMENT ON CONTRACT SIZE

Cost Variable	a	b	r	F	Results*
Initial Contracts	31.72	.02	.26	1.70	non-significant
Completed Contracts	81.78	.01	.21	1.53	non-significant

*.05 Level of Significance

The null hypothesis of no correlation cannot be rejected in either case. The argument previously stated is judged false. Therefore, based on analysis of the sample data, the size of the contract (either initial cost, or completed contract cost) is not an indicator of the expected award fee payment.

b. Effect of Magnitude of Award Fee on Award Fee Payment. The supposition has been made that the absolute value of the maximum potential award fee (award fee pool) has a positive influence on the award fee payment. The argument goes that contractors will tend to "work harder" for the bigger potential awards and ignore the smaller awards, a very logical assumption. This is closely related to the argument above but incorporates an additional factor, the percentage of costs that constitute the award fee. This hypothesis was tested using the dollar value of the award fee pool at contract initiation and at contract completion.

TABLE 8

REGRESSION OF AWARD FEE PAYMENT ON SIZE OF AWARD FEE POOL

Award Fee Magnitude	a	b	r	F	Results*
Initial Contracts	81.35	.02	.19	1.47	non-significant
Completed Contracts	82.90	.001	.01	1.02	non-significant

*.05 Level of Significance

The null hypothesis of no correlation cannot be rejected in either case. Therefore analysis of the data does not provide any evidence of a relationship between the percentage of the available award fee pool that is actually paid and the size in dollars of the pool either at initiation of the contract or at contract completion! On first inspection this result was surprising, but reinspection of the data gave no reason to doubt the lack of correlation; and other factors among the contracts which might influence the size or earned amount of the award fee were not constant.

c. Effects of Relative Size of Potential Award Fee on Award Fee Payment. The argument has been presented that the percentage of potential award fee earned (award fee payment) would increase as the award fee pool becomes a larger percent of the estimated contract cost; i.e., the larger the award fee pool in relation to estimated cost, the more incentive it would provide the contractor to perform. A counter argument maintains that the more complex, higher risk contracts would have the higher award fee and this factor would not influence the percentage of award fee earned. The relative size hypothesis was tested using the award fee pool as a percentage of cost at contract initiation and contract completion.

TABLE 9

REGRESSION OF AWARD FEE ON RELATIVE SIZE OF AWARD FEE POOL

Relative Award Fee	a	b	r	F	Results*
Initial Contracts	83.59	-0.12	-0.02	1.04	non-significant
Completed Contracts	87.12	-0.61	-0.12	1.27	non-significant

*.05 Level of Significance

The null hypothesis of no correlation cannot be rejected in either case. Therefore analysis of the data does not provide any evidence of a relationship between the percentage of available award fee pool that was actually paid and the relative size of the pool in relation to estimated cost.

d. Effect of Magnitude of Fixed Fee on Award Fee Payment. The assumption is sometimes made that the base fee of an award fee contract acts as a cushion making the contractor less interested in earning the award fee. If this hypothesis is true then it follows that there is a negative correlation between the absolute size of the base fee and percentage of available award fee earned. This hypothesis is tested by the regression analysis below.

TABLE 10

REGRESSION OF AWARD FEE PAYMENT ON MAGNITUDE OF FIXED FEE

Magnitude Fixed Fee	a	b	r	F	Results
Initial Contracts	87.00	-0.44	-0.52	3.17*	significant
Completed Contracts	84.45	-0.07	-0.32	1.94	non-significant

*.05 Level of Significance; $F_{(.05,\ 17,\ 17)} = 2.28$

The null hypothesis of no correlation between award fee payment and magnitude of fixed fee is rejected on the basis of data on initial contracts. However, the null hypothesis does hold up for completed contracts. This inconsistency is troublesome. Close inspection of the raw data indicate some slight shifts in the fixed fee during execution and major shifts in the absolute value of fixed fee primarily as a result of frequent major changes in estimated contract costs. Interpretation of this result is deferred until the investigation of the relationship between award fee payments and relative (%) fixed fee which follows.

e. Regression of Award Fee Payment on Relative Size (%) of Fixed Fee. The argument of subsection d above can be restated with the relationship between award fee and relative size (percent of cost) of the fixed fee. This relationship is tested below.

TABLE 11

REGRESSION OF AWARD FEE ON RELATIVE SIZE OF FIXED FEE

Relative Size FF	a	b	r	F	Results
Initial Contracts	88.66	-2.55	-0.46	2.71*	significant
Completed Contracts	88.41	-2.46	-0.45	2.64*	significant

*.05 Level of Significance; $F_{(.05,\ 17,17)} = 2.28$

The null hypothesis of no correlation is rejected in both cases. This clearly indicates the important result that award fee payments are negatively related to the fixed fee when expressed as a percentage of expected cost and that this relationship is consistent with conditions at both the beginning and at the end of the contract. Combining this result with result d above it is evident that a relationship does exist between the award fee payment and the fixed fee and that this relationship is consistent at both contract initiation and contract completion when the fixed fee is expressed as a percentage of cost. This result suggests the desirability of investigating the fee ratio and its possible effect on the award fee payment. Further discussion will follow after that analysis.

f. Effect of Award Total Fee Ratio on the Award Fee Payments. It seems reasonable to assume that as more of the total fee is allocated to the award fee and less to the fixed fee the contractor would be more highly motivated and would likely earn a higher percentage of the available award fee. This hypothesis is tested in the following regression using the ratio of award fee to total fee for the independent variable.

TABLE 12

REGRESSION OF AWARD FEE PAID ON AWARD TOTAL FEE RATIO

Fee Ratio	a	b	r	F	Results*
Initial Contracts	63.99	0.24	0.43	2.51*	significant
Completed Contracts	63.23	0.25	0.46	2.70*	significant

*.05 Level of Significance; $F_{(.05,\ 17,17)} = 2.28$

The null hypothesis of no correlation is rejected in both cases. A positive relationship exists that is consistent for the fee structure at contract initiation and contract completion between the amount of available award fee paid and the ratio of the potential award fee to the total fee. The higher the award fee relative to the total fee, and therefore the smaller the fixed fee, the larger the percent of potential award fee that is paid. This result is also consistent and similar to the closely related analysis in subsection e which it strongly supports. The results obtained in the various regression analyses are drawn together in the next subsection.

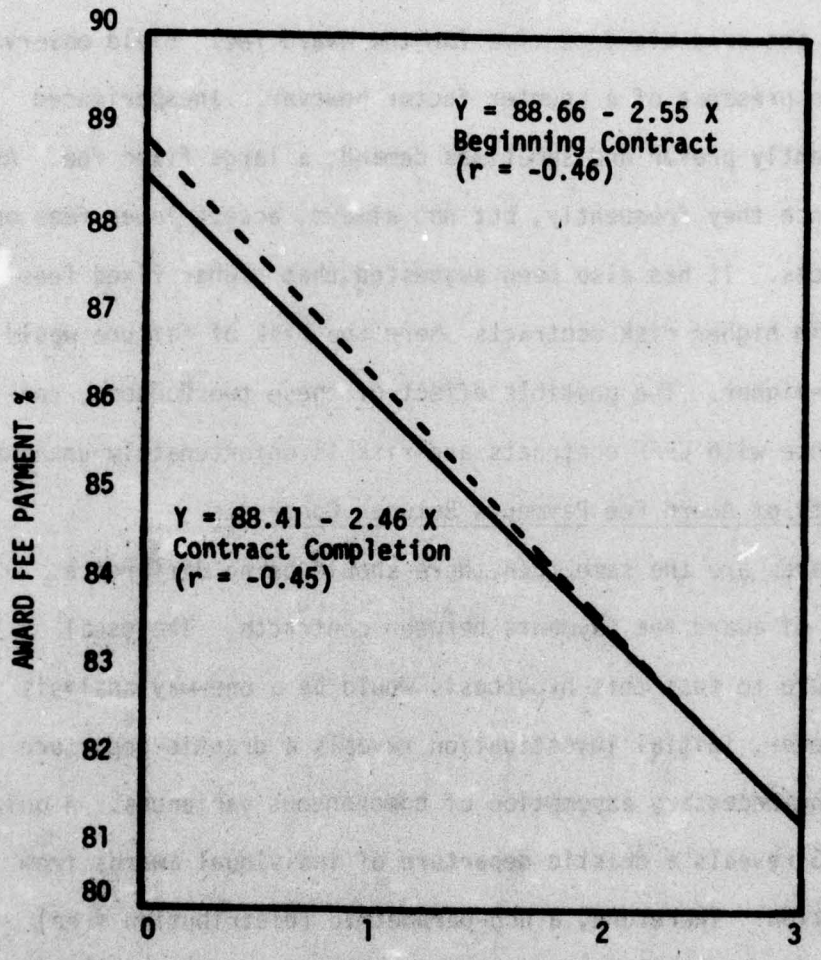
g. Summary and Results of Regression Analysis. The arguments that the award fee payment is influenced by size of contract or by size of potential award fee, either in absolute or relative terms, have been shown to be unsupportable and were judged false. The award fee payment acts as though it is independent of these factors as indeed it should be if the award fee concept is working correctly. The award fee payment should be a function of performance.

However, the award fee payment does exhibit a weak relationship with the fee structure as expressed by the ratio of the award fee to the total fee. In view of the facts that; the total fee is composed of the

fixed fee and award fee, and since the award fee has been shown unrelated to the award fee payments, and in view of the close similarity of results and similar consistency between the analysis of e and f above it becomes obvious that the fixed fee is the variable actually associated with the award fee payment. The most consistent and therefore reliable and useful measure revealing the effect of the fixed fee is the fixed fee expressed as a percentage of cost. The relationship developed for this variable for completed contracts in e above will be used below to draw statistical inferences generalizing this relationship.

h. Inferences from the Fixed Fee Award Fee Payment Relationship. As indicated previously the linear relationships between the relative fixed fee and award fee payment is statistically significant at the 5% level of significance. It is now of interest to know how much of the variation in award fee payments can be attributed to differences in the fixed fees. Such an estimate is given by $100 \cdot r^2$ where r is the Pearson product - moment coefficient of correlation. Such calculations for the two relationships developed in subsection e yield results of 21.16% for initial contracts and 20.25% for completed contracts. Therefore, it is concluded that for our sample, variations in percent of fixed fee accounts for or explains slightly over 20% of the observed variation in award fee payments. The relationships are expressed graphically in Figure 2.
It would be of obvious interest to place confidence intervals on the

FIGURE 2 RELATIONSHIP OF AWARD FEE PAYMENT TO FIXED FEE ESTIMATED FOR SAMPLE DATA*



*This relationship is statistically significant at the 95% confidence level and explains about 20% of the sample variation in award fee payments within the sample of Army contracts.

estimates and to estimate the parameters for the population of award fee contracts, not just those that were sampled, but time limitations prevent doing so at this point.

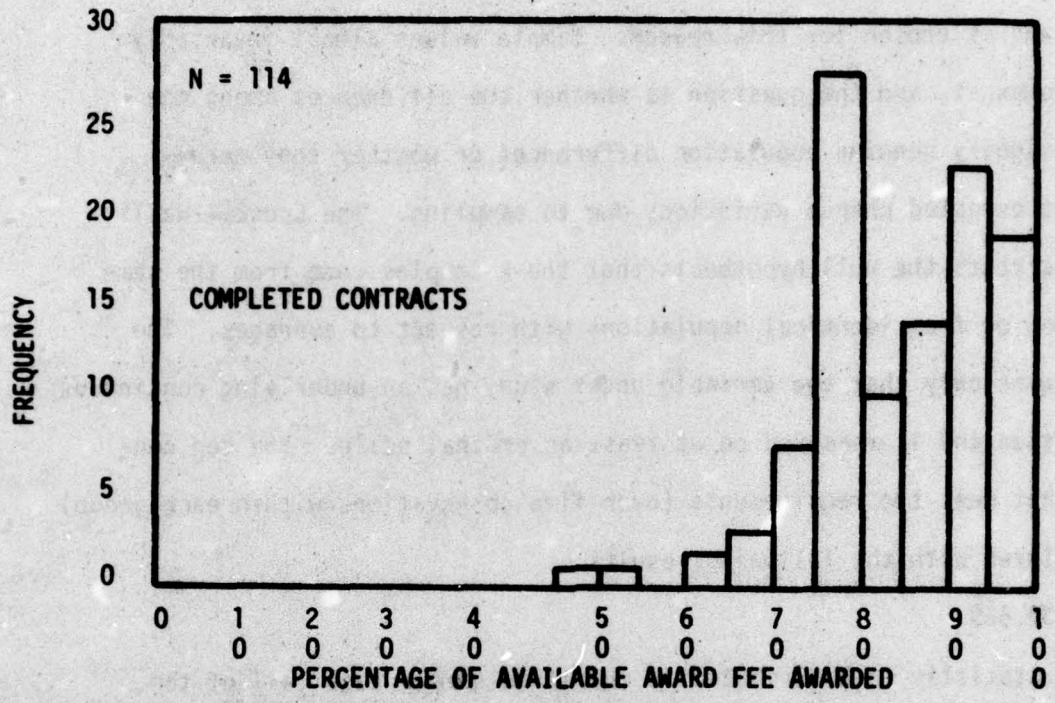
This result supports the original hypothesis that increases in the fixed fee tend to act as a dis-incentive for the award fee. Field observations indicate the presence of a counter factor however. Inexperienced contractors frequently prefer and sometimes demand, a large fixed fee. As they gain experience they frequently, but not always, accept lower fees on subsequent contracts. It has also been suggested that higher fixed fees are associated with higher risk contracts where the risk of failure would be expected to be higher. The possible effect of these two factors, contractors' experience with CPAF contracts and risk is unfortunately unknown.

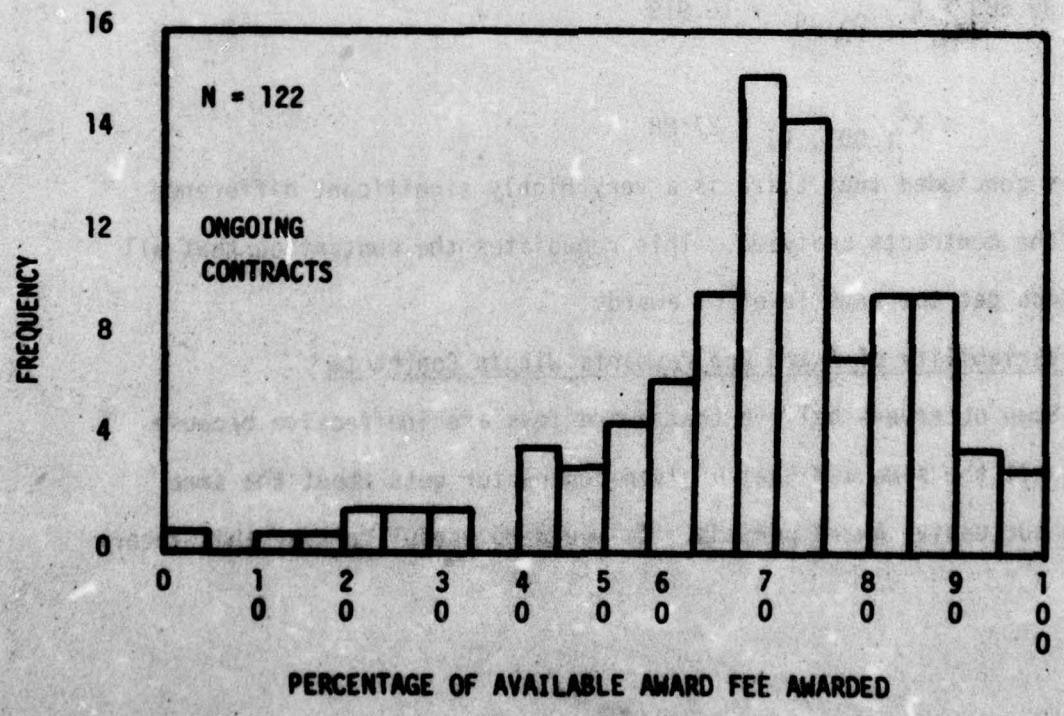
4. Variability of Award Fee Payments Between Contracts

If all awards are the same then there should be no difference between the level of award fee payments between contracts. The usual parametric procedure to test this hypothesis would be a one-way analysis of variance. However, initial investigation reveals a drastic departure from the underlying necessary assumption of homogeneous variances. A quick glance at Figure 3 reveals a drastic departure of individual awards from a normal distribution. Therefore, a non-parametric (distribution free) method is used to investigate the differences between contracts. The Kruskal-Wallis one-way analysis of variance by ranks is an extremely useful

FIGURE 3 DISTRIBUTION OF

INDIVIDUAL AWARD FEE PAYMENTS





test for deciding whether k independent samples are from different populations and is chosen for this reason. Sample values almost invariably differ somewhat, and the question is whether the differences among the samples signify genuine population differences or whether they merely represent expected chance variations due to sampling. The Kruskal-Wallis technique tests the null hypothesis that the k samples come from the same population or from identical populations with respect to averages. The test assumes only that the variable under study has an underlying continuous distribution and is measured on at least an ordinal scale. The ten contracts that meet the requirements (over five observations within each group) were analyzed with the following results:

$H = 39.669$

This statistic is distributed in the large sample case (all of the requirements for which have been met by our application) as Chi-square with k - 1 degrees of freedom. Therefore since;

$$H = 39.669 > X^2_{(.05,\ 9)} = 16.919$$

and;

$$> X^2_{(.001,\ 9)} = 27.88$$

It is concluded that there is a very highly significant difference between the contracts analyzed. This repudiates the contention that all contractors get the same level of award.

5. Variability of Award Fee Payments Within Contracts

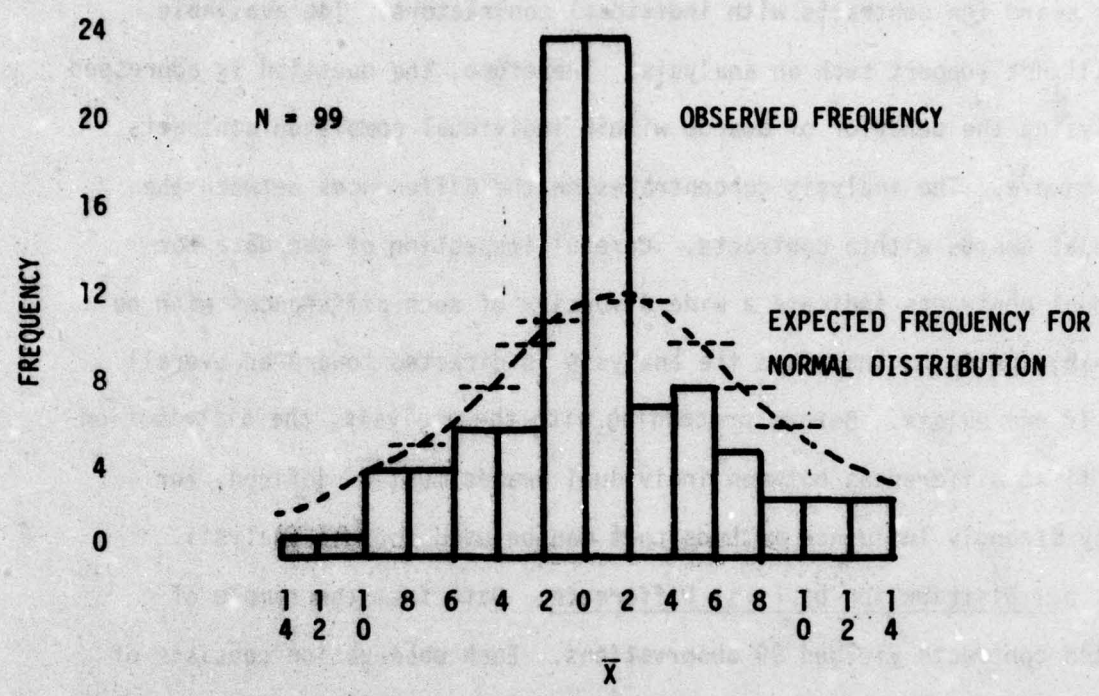
Some observers believe that award fees are ineffective because they are all the same and that a given contractor gets about the same award in successive award periods. It would be useful to test this theory

between contracts, however, to do so would require data of successive similar award fee contracts with individual contractors. The available data will not support such an analysis. Therefore, the question is addressed by analyzing the behavior of awards within individual completed contracts of our sample. The analysis concentrates on the differences between the individual awards within contracts. Careful inspection of the data for individual contracts indicate a wide diversity of such differences with no discernable pattern, therefore the analysis is directed toward an overall effect if one exists. Before proceeding with the analysis, the distribution of the first differences between individual awards must be defined, for that may strongly influence methods that can be used for the analysis.

a. Distribution of First Difference. Data from the sample of completed contracts yielded 99 observations. Each observation consists of the difference between individual awards (percentage of potential actually paid) within a given contract. Analysis of this data will provide information about the "growth" of award fees within contracts. Contracts with only one award were obviously excluded since they contain no such data. Contracts paid on the billing fee principle were also excluded since the data from them would distort the effect as these fees are later adjusted. The data set represents the variation between successive awards within completed contracts. Figure 4 displays this data in a histogram together with the normal approximation

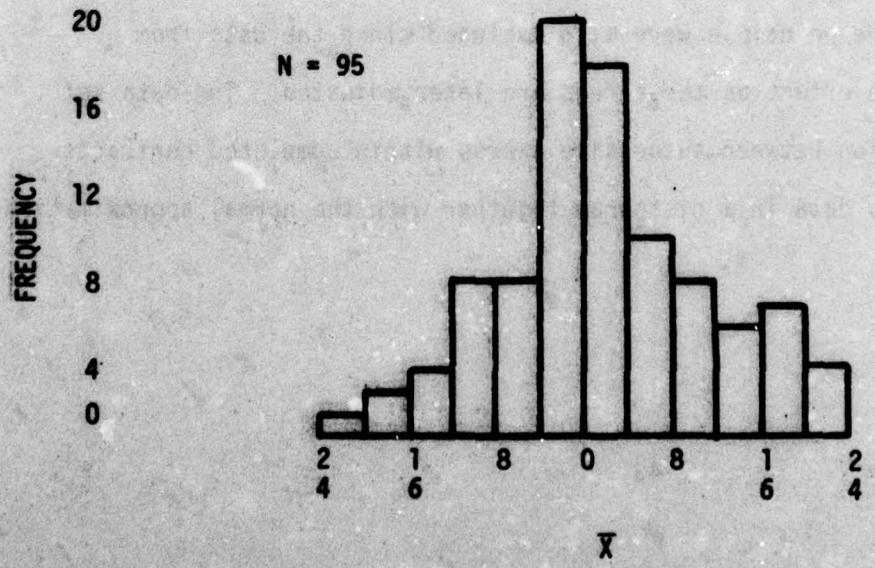
FIGURE 4 DISTRIBUTION OF FIRST DIFFERENCES

BETWEEN INDIVIDUAL AWARDS OF COMPLETED CONTRACTS



DISTRIBUTION OF FIRST DIFFERENCES

BETWEEN INDIVIDUAL AWARDS OF ONGOING CONTRACTS



to it. The normal approximation shows the expected distribution for a sample of the same size and with the same mean and standard deviation as the observed data. The departure from normality is obvious. In order to determine if such a departure is likely attributable to chance a Chi-Square test of goodness of fit was used. The results are:

$$X^2_{(m-3)} = 40.597 > X^2_{(.05,\ 8)} = 15.507$$

$$> X^2_{(.01,\ 8)} = 20.090$$

This indicates a departure, significant at the 1% level, from a normal distribution. Therefore, the sample may <u>not</u> be regarded as a random sample drawn from a normal distribution. A close inspection of Figure 4 and the expected versus the observed frequencies within the Chi-Square Table (not shown) indicate a generally symmetrical design with an "excess" of observations near the mean, a "deficiency" at a medium distance from the mean and the expected frequencies at the extreme deviation from the mean. Because of the nature of these deviations the use of parametric measures is justified to test that the mean is significantly different from zero. The large sample test for μ based on the Z statistic is used as follows:

$$Z = \frac{\bar{x} - \mu o}{S/\sqrt{n}}$$

where;

$$Ho = \mu = 0$$

$$H_1 = \mu > 0$$

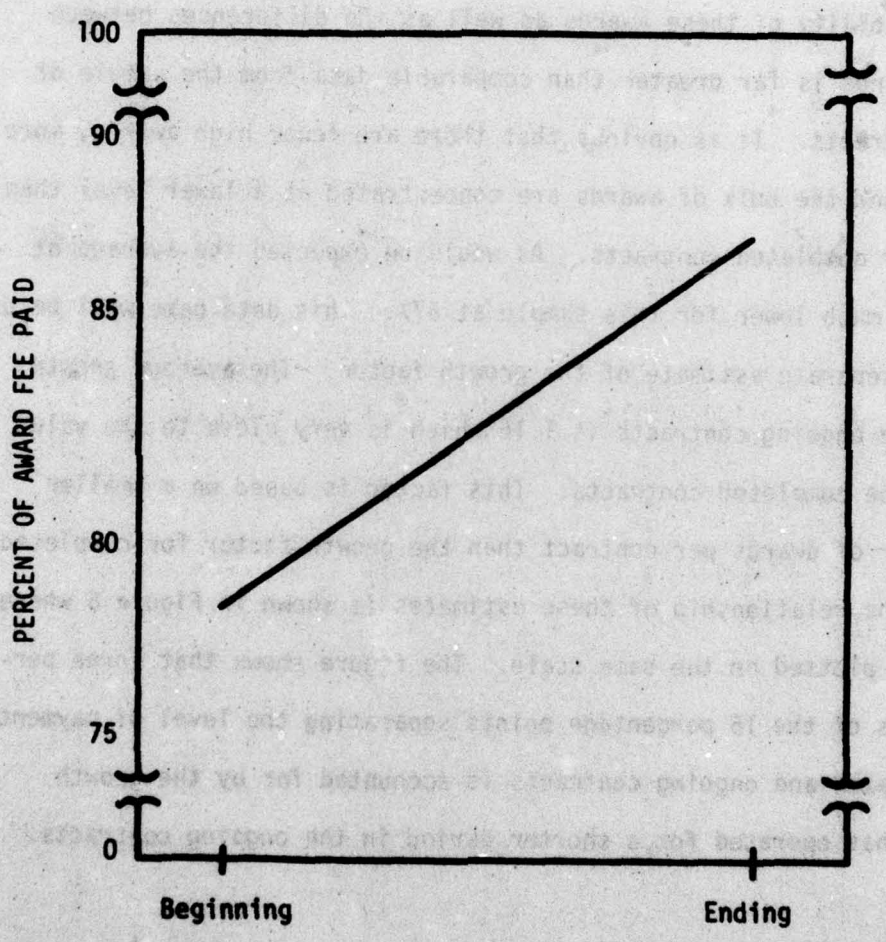
decision criteria; reject null hypothesis (of no difference) if $Z > Z$ '.
The results are:

$$Z = 1.978 > Z_{(.05)} = 1.64$$

Therefore the conclusion is reached that the mean of the first difference is significantly different from zero. In fact, since this is a "one tail test" we may conclude that the mean is larger than zero and is not likely to have occurred by chance alone. This indicates on the average a tendency toward higher awards as the contract progresses. This is an overall effect with individual contracts showing large deviations from the effect. The influence of the average effect which is assumed to be linear is shown in Figure 5 where the effect is centered on the level of award fees computed earlier, and extended over the average length of the contracts observed. Next, the absolute value of the first differences are investigated.

b. Analysis of Absolute Value of First Differences. It was shown above that the changes from award to award within contracts do not cancel out but result in a positive value significantly different from zero. Therefore they are not an accurate estimator of the next award. Of additional importance is the absolute value of the differences. These values reflect the magnitude of the changes regardless of direction. The range of the absolute value of the first difference is from less than one-tenth of a percentage point to over 28%. The average is 5% points. This gives an

FIGURE 5 AVERAGE RELATIONSHIP OF AWARD FEE PAYMENT TO STAGE OF CONTRACT COMPLETION ESTIMATED FOR SAMPLE DATA*



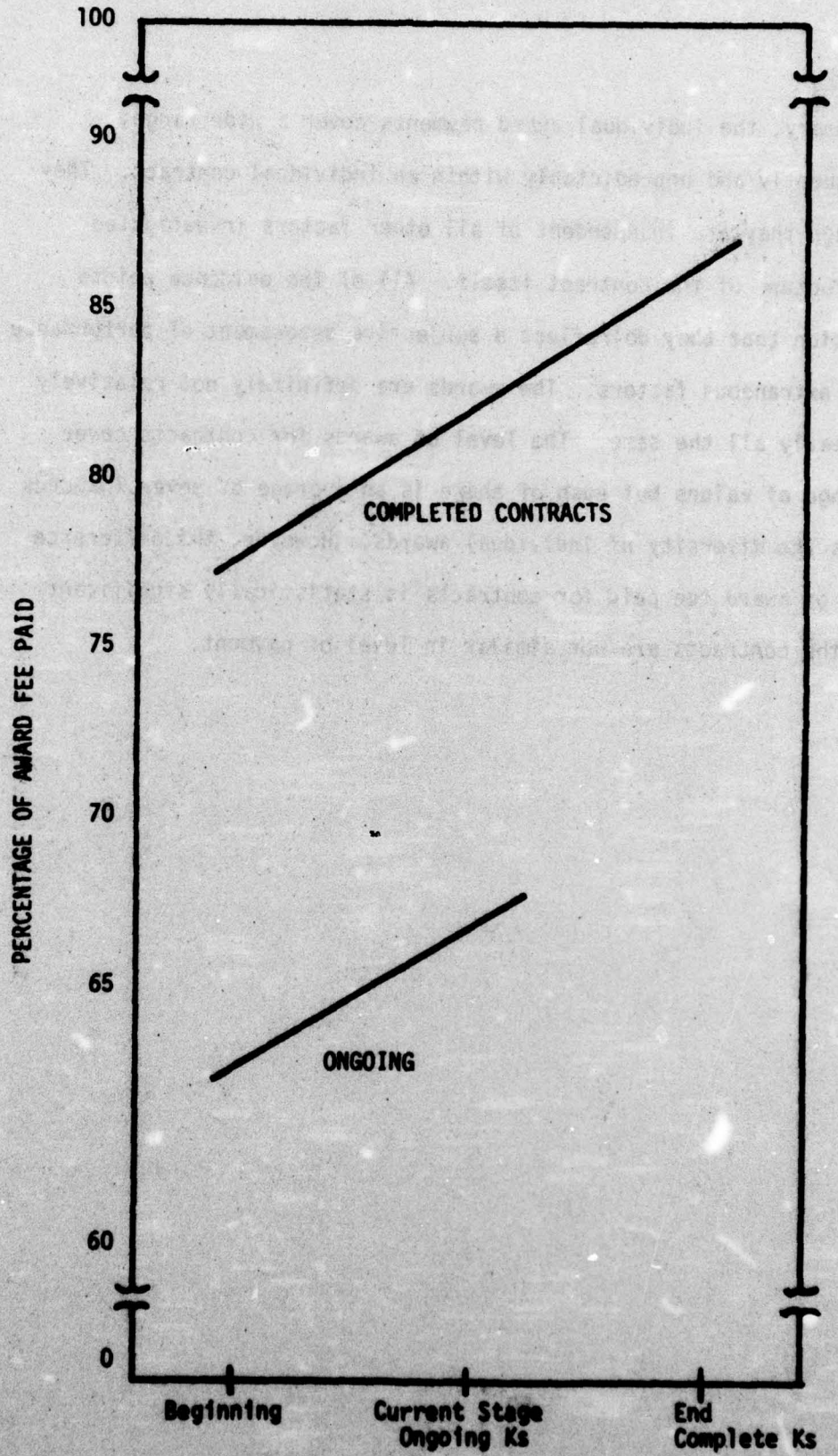
*Trend significant at the 95% level of confidence

indication of the average fluctuation of awards within individual contracts. The relation between this factor and the level of the individual contract is of interest but is not investigated here.

6. Findings from Analysis of Ongoing Contract Data

The distribution of the individual awards for ongoing contracts and the first differences are shown in Figure 3. It is immediately apparent that the variability of these awards as well as the differences between successive awards is far greater than comparable data from the sample of completed contracts. It is obvious that there are fewer high awards, more lower awards and the bulk of awards are concentrated at a lower level than the awards for completed contracts. As would be expected the average of the awards is much lower for this sample at 67%. This data base will be used to develop a separate estimate of the growth factor. The average growth factor for the ongoing contracts is 1.16 which is very close to the value of 1.28 for the completed contracts. This factor is based on a smaller average number of awards per contract than the growth factor for completed contracts. The relationship of these estimates is shown in Figure 6 where they are both plotted on the same scale. The figure shows that three percentage points of the 16 percentage points separating the level of payments for the completed and ongoing contracts is accounted for by the growth factor which has operated for a shorter period in the ongoing contracts.

FIGURE 6 COMPARISON OF GROWTH FACTORS FOR AWARD FEE



7. Summary

In summary, the individual award payments cover a wide range, fluctuate frequently and unpredictably within an individual contract. They behave as though they are independent of all other factors investigated except the structure of the contract itself. All of the evidence points to the conclusion that they do reflect a subjective assessment of performance and not other extraneous factors. The awards are definitely not relatively constant or nearly all the same. The level of awards for contracts cover a narrower range of values but each of these is an average of several awards which obscures the diversity of individual awards. However, the difference in percentage of award fee paid for contracts is statistically significant showing that the contracts are not similar in level of payment.

CHAPTER IV

CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

1. Level of Award Fees

It is concluded that the mean current level of award fee payments for the 19 contracts is 83% of the maximum available award fee with a standard deviation of 6%. Based on the DOD Contractor Performance Evaluation and the NASA Rating System for CPAF support contracts this is a reasonable and desirable level. These measurements are, in effect, field assessments of the relative success of each contractor in meeting his distinctive goals; they are, in fact, a field assessment of effectiveness. If the concept is successfully applied the awards should be high. The current level reflects overall excellence, but not outstanding performance. There appears to be a decrease in award fee level for ongoing contracts that should be a subject for continuing research.

2. Procedures for Determining Award Fees

Several problems have been previously reported in the implementation of award procedures. In addition, some new problems that have been unreported were uncovered.

a. **Initial Problems Affecting Effectiveness of Award Fee Procedures.** In the initial stages of award fee contracting many previously reported problems emerge such as, establishing the correct organizational and personnel level for the award fee evaluation board

and the fee determining official. Problems also develop with communications both within the government and between the government and contractor as the administrative structure and procedures develop.

b. Continuing Problems Affecting Effectiveness of Award Fee Procedures. Problems resulting from the general nature of the method and different philosophies applied under widely differing circumstances continue. They revolve around the basic nature and structure of the evaluaton (measuring) system and the methods applied in developing the scores and awards. They are basically problems of measurement, technique and philosophy resulting from judgemental evaluation.

3. Effectiveness of the Award Fee Concept

As currently applied in the Army the award fee concept is effective and would earn an excellent rating based on either the DOD or NASA scoring system. It is regrettable that it was not practical to develop the cost side of the cost-effectiveness question. If data could be obtained to support such a detailed analysis a clearer picture of the whole process would emerge. However, in view of the difficulties encountered with that approach, this report concentrates on the effectiveness portion of the question. Most of the initial problems that are quite prevalent when CPAF contracts are first employed are resolved as experience is developed, administrative procedures and practices are refined and as communications both within the government and between the government and contractors are

improved. Award fees appear to be independent as they should be of several contractual factors that are often said to exert an undesirable influence. They vary widely and do not follow any recognizable pattern except for an expected growth factor. There are, however, some problems that continue to exist and detract from achieving maximum effectiveness of the award fee system.

a. External Effects Affecting Effectiveness of the Award Fee Concept. Several external contractual factors were studied and not found to detract from the effectiveness of the award fee concept as currently applied in the field. Many of the suppositions concerning these factors appear to stem from a lack of knowledge of the detail workings of the system. Little previous study has been directed in this area.

4. Remaining Problems

Problems remain in making subjective evaluations and combining them into numerical scores which are then converted to award fees. A problem of bias was discovered making it very unlikely that a contractor could obtain the maximum award fee under the existing system. Somewhat different procedures and philosophies are employed in different commands making it unlikely that many people gain from all of the experience available within the total system. The dynamic nature and uniqueness of individual applications make different philosophies

necessary but also prohibit the development of a practical theory for guidance.

a. Additional Research Needed. Little factual information exists providing an overall picture of the operation of the award fee contracting system. Most of the knowledge gained has been limited to the experience from a few contracts or within a command. The interchange of ideas and lessons learned throughout the Army would be very useful. Research is needed to develop a more effective method of combining subjective evaluations into overall scores. Research into command differences and the apparent decline in award level for on-going contracts would be helpful in providing a factual basis for more effective decisions in future award fee contracting. Also needed is a better view of the unique administrative costs involved in award fee contracting.

B. RECOMMENDATIONS

As a result of this study, the following recommendations are made:

1. Continue use of award fee contracts.

2. Continue present guidance until research and feedback from field experience provides the factual basis for improvement.

3. Continue research concentrating in the following areas:

   a. Measurement procedures and evaluation plans.

   b. The apparent changing level of award fee payments.

   c. Differences in application of award fee contracts between commands and over time.

4. DARCOM establish an award fee policy to improve the interchange of ideas/experience and to disseminate the results of research in the area of award fee contracts.

a. Establish within DARCOM an individual to serve as a point of contact to improve intercommand communication.

b. Sponsor periodic workshops for people actively engaged in developing and administrating award fee contracts to aid in the dissemination of experience gained locally throughout the Army.

APPENDIX A

DESCRIPTION OF SAMPLE DATA FOR COMPLETED CONTRACTS

Basic data in the sample of completed contracts consists of the estimated cost for the initial contract and estimated cost for the completed contract and the amount of associated fees. The fees are broken down into fixed fee and the maximum award fee allocated for that contract (award fee pool) as envisioned at the beginning of the contract and again at contract completion. These two points contrast what was initially planed with what actually happened. In addition, the award fee that was actually paid during the life of the contract was obtained in order to compute the percentage of the award fee that was actually paid. For the purpose of this study a contract is considered completed when the final cost and fees have been established. Additional data were collected on the amount and dates of individual awards and the dates of contract beginning and ending. These factors are not discussed here but are brought into play elsewhere in the analysis.

Summary statistics describing the basic data are presented in Table A-1, (note that the estimated costs are expressed in millions of dollars and the fees are expressed in thousands). The sample mean is used to describe the central tendency and the usual measures of dispersion about the mean, the standard deviation and the standard error are used to describe the variability. Caution should be exercised

TABLE A-1 SAMPLE MEASURES OF CENTRAL TENDENCY AND DISPERSION (BASE VALUES)

MEASURE OF CENTRAL TENDENCY - COMPLETED CONTRACTS

DESCRIPTIVE STATISTIC		Estimated Cost (Million $)		Fixed Fee (Thousand $)		Award Fee (Thousand $)		
Descriptor	Statistic	Original Contract	Completed Contract	Original Contract	Completed Contract	Original Contract	Completed Contract	Actually Paid
Sample Mean	$(W\bar{X}_p)$	5.96	9.54	89.75	181.22	402.40	634.64	527.19
		MEASURES OF DISPERSION						
Standard Deviation	(SD_p)	7.53	10.62	71.30	251.02	434.98	634.84	561.29
Standard Error	(SE_p)	1.72	2.43	16.35	57.58	99.79	152.53	128.75
Highest Value	(X_H)	35.06	37.17	237.70	1023.41	1988.71	2363.99	1980.81
Lowest Value	(X_L)	1.24	1.59	0	0	82.14	103.33	82.14
Range	(X_R)	33.82	35.59	237.70	1023.41	1906.57	2260.67	1898.67

in drawing the usual conclusions from only those measures, however. To assist in a more accurate assessment of the basic data the highest and lowest value observed in the sample and the range between the two are also noted in Table A-1. In analyzing any of the costs or fees summarized here it is obvious that the mean does not fall at about the midpoint of the range of highest and lowest values. In fact, in all cases, the mean falls much closer to the lowest value than the highest. The practical meaning of this phenomina is that a few large contracts are heavily influencing the results because the distribution of costs and fees is strongly skewed to the right.

Key values computed from the basic sample data

From the dollar values of contracts, costs and fees just described in the previous section, several key percentage factors were computed which relate the specific fees to their associated contract costs. A summary of this derived data is presented in this section in Table A-2. As these data are the elements of the fee structure, the heart of an award fee contract, they should be of considerable interest to contracting officers, contract specialists and others directly involved in award fee contracting. In order to aid in interpreting the data presented in Table A-2 a brief discussion follows.

Individual values for each factor were computed for each individual contract using the appropriate dollar value of cost and fees. The percent of maximum award fee actually awarded here applies to the

TABLE A-2 SAMPLE MEASURES OF CENTRAL TENDENCY AND DISPERSION (COMPUTED VALUES)

MEASURES OF CENTRAL TENDENCY - COMPLETED CONTRACTS

DESCRIPTIVE STATISTIC							
Descriptor	Statistic	Fixed Fee as % of Estimated Cost		Award Fee as % of Estimated Cost		% of Maximum Award Fee Actually Awarded (Total Contract)	Maximum Award Fee as % of Total Fee Pool for Completed Contracts
		Original Contract	Completed Contract	Original Contract	Completed Contract		
Mean (weighted by contract size)	$(W\bar{X}_p)$	1.50	1.90	6.75	6.66	83.07	77.78
Mean (Unweighted)	$(\bar{X}_p)$	2.21	2.20	7.27	6.82	82.98	77.26
				MEASURES OF DISPERSION			
Standard Deviation	(SD_p)	1.11	1.13	1.33	1.04	5.93	N/A*
Standard Error	(SE_p)	0.25	0.26	0.30	0.23	1.36	N/A
Highest Value	(X_H)	3	3	10.86	9	93.62	100
Lowest Value	(X_L)	0	0	5	4.55	75.34	69.83
Range	(X_R)	3	3	5.86	4.45	18.28	30.17

*This variable does not approximate a normal distribution therefore the (SD_p) and (SE_p) are not appropriate indicators of the true dispersion.

total contract. It shows the award fee that was actually earned during the life of the contract as a percent of the maximum that the contractor theoretically could have earned had he performed perfectly and been paid accordingly. This measure can only be calculated after the contract has been "completed."

The mean of the individual contract values along with the associated standard deviation and standard error are computed in the usual way and presented in Table A-2. As was pointed out earlier, caution is required in interpreting these statistics. The very large standard deviations in relation to the range of values observed and the location of the mean in relation to the highest and lowest observed values indicate that the usual assumption of an underlying normal distribution does not hold exactly. The only exception is the percentage of maximum award fee actually awarded. For these reasons a derived mean developed from the sample totals is presented as a more useful descriptor of the sample data. This procedure has the same effect as weighting each individual contract value by the contract size (appropriate dollar value) but was selected for computation to reduce rounding errors. (note that the two measures of central tendency, the weighted mean and the unweighted mean, give identical results, except for rounding errors, in the case of the percentage of award fee awarded). The highest and lowest observed values and the range between them is also displayed as an aid to better understanding of the properties of the data base.

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